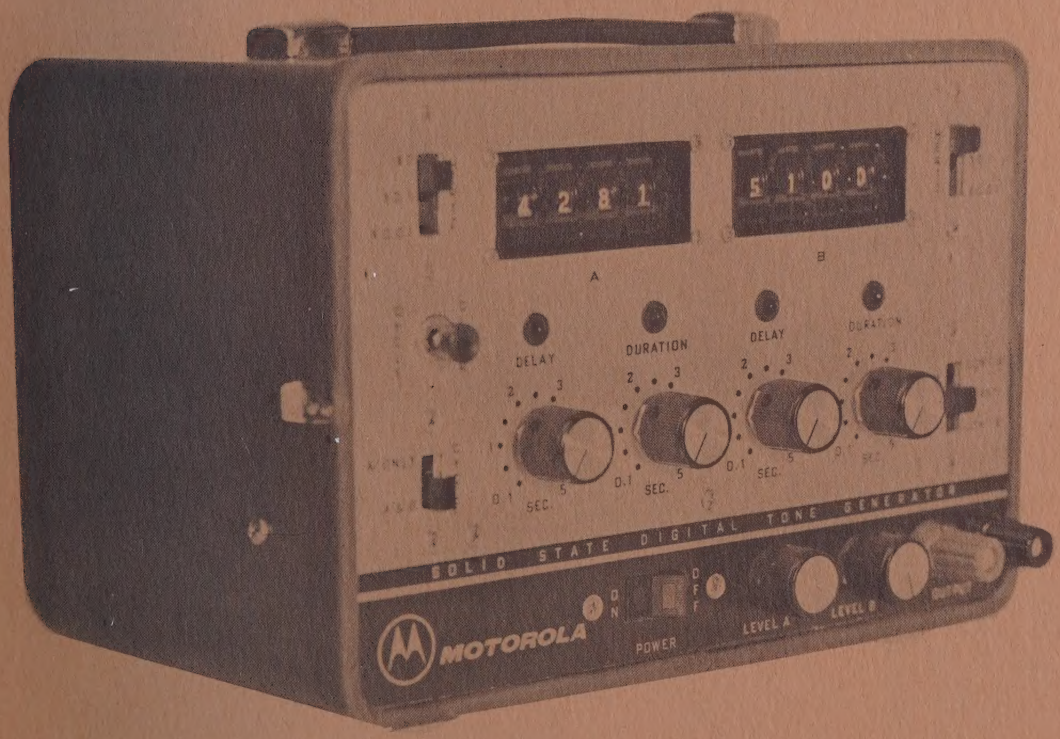
MOTOROLA

Test Equipment

SOLID STATE DIGITAL TONE GENERATOR

MODEL S-1333A



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MOTOROLA

SOLID STATE DIGITAL TONE GENERATOR

MODEL S-1333A

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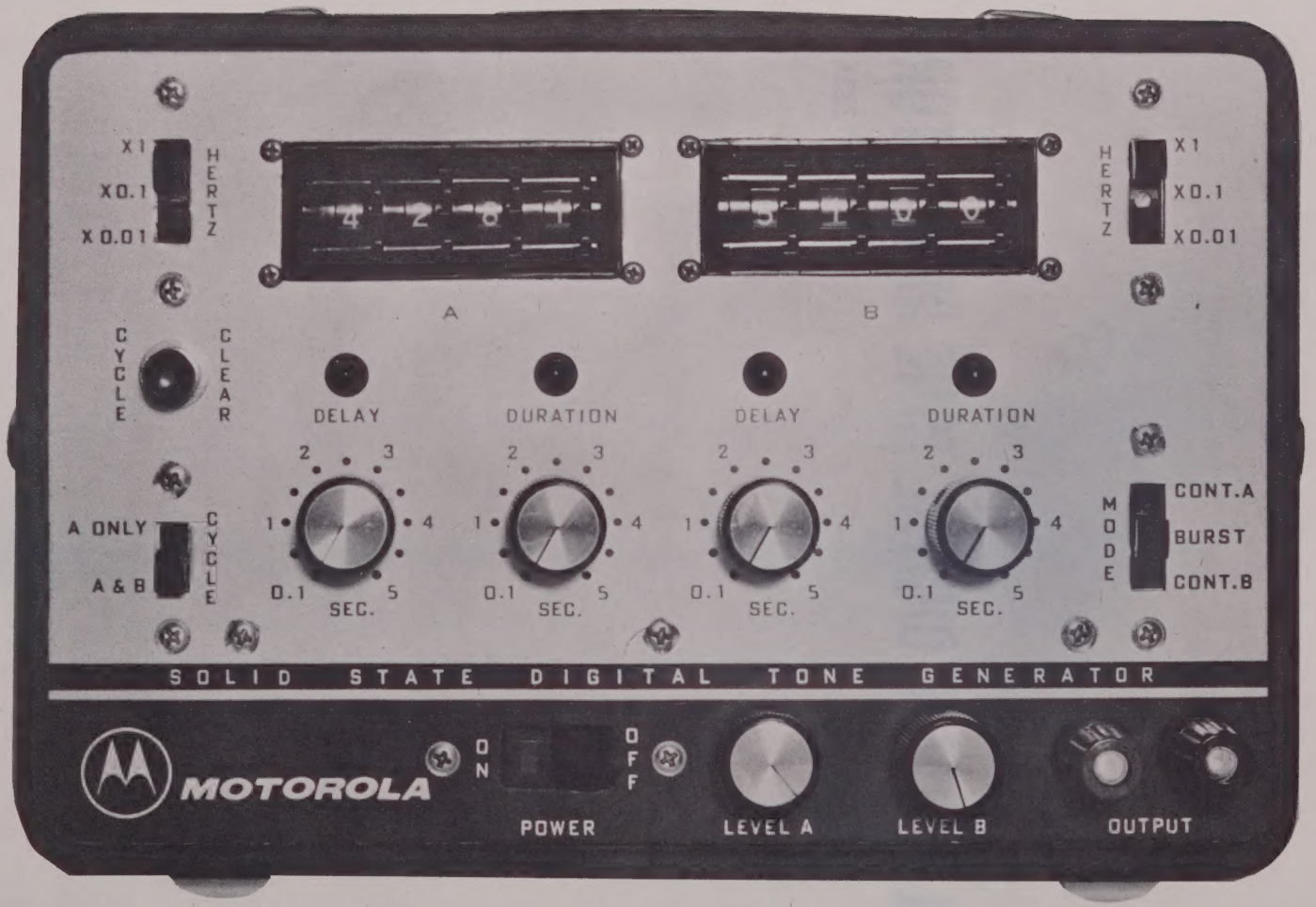

MODEL S-1333A

SOLID STATE DIGITAL TONE GENERATOR

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When ordering replacement parts, the complete part number must be used. Motorola Parts Depots are located at the following addresses:

2333 Utah Avenue, El Segundo, California 90245
Tel: 213-644-1101 - TWX: 910-348-6278

1170 Chess Drive, San Mateo, California 94404
Tel: 415-349-3111: TWX: 415-375-3877

P.O. Drawer 1, Forest Park, Georgia 30050
Tel: 404-762-6183: TWX:810-751 8300

1301 E. Algonquin Rd., Shaumberg, Illinois 60172
Tel: 312-358-7900

85 Harristown Road, Glen Rock, New Jersey 07452
Tel: 201-447-4000 : TWX: 710-988-5602

12955 Snow Road, Parma Ohio 44130
Tel: 216-267-2210 : TWX: 810-421-8845

3220 Belt Line Road, Dallas, Texas, 75207
Tel: 214-241-2151 : TWX 910-860-5505

-REPAIR:

In the event that factory repair is required, return unit to your nearest parts depot. See addresses above.

1. SPECIFICATIONS

a. Frequency - 10.00 - 99.99 Hz (.01 Hz Increments)
100.0 - 999.9 Hz (0.1 Hz Increments)
1,000 - 9,999 Hz (1.0 Hz Increments)

b. Resolution - 0.1% (Four significant digits)

c. Accuracy - Plus or minus .001% at 20° C.

d. Stability - Plus or minus 50 ppm/0° to 50° C.

e. Aging - Plus or minus 1 ppm/yr.

f. Output - Independently variable each tone to 3v. rms. into 600 ohm load.

g. Level Controls - 20 db. min.

h. Distortion - Typically 1.5% at 20° C.

i. Initial Tone Delay - 0.1 to 5 sec.

j. Tone Duration - 0.1 to 5 sec.

k. Inter-Tone Delay 0.1 to 5 sec.

l. Operating Temperature Range - 0° to 50° C.

m. Power Consumption - 115 V.A.C. 50-60 Hz, 15 watts

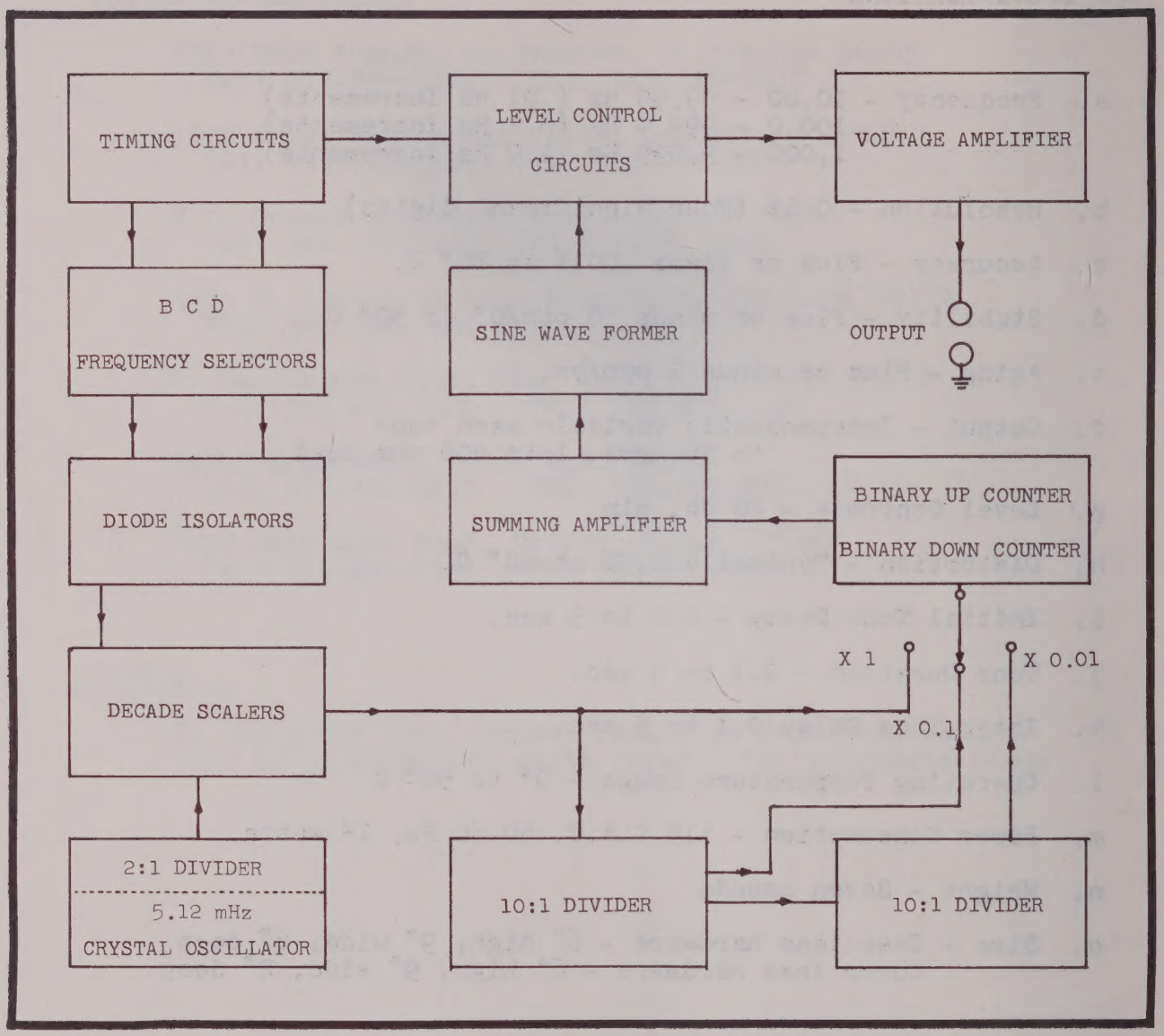
n. Weight - Seven pounds

o. Size - Case less hardware - 6" high, 9" wide, 6" deep
Cover less hardware - 6" high, 9" wide, 2" deep

2. DESCRIPTION

a. The Model S1333A Solid State Digital Tone Generator uses digital and linear integrated circuits to synthesize audio tones with crystal oscillator accuracy and stability.

b. Seperate thumbwheel switches select tones which may be generated singly or sequentially with controlled "on" times and "delay" times.



BLOCK DIAGRAM

With reference to the block diagram, it may be noted that timing circuits of controlled duration alternate gate frequencies A or B 'on and 'off' for preselected time periods.

The BCD logic from the frequency selectors is used to control decade scalers which very accurately multiply the output frequency of the crystal oscillator. The first digit of the thumbwheel switch is fitted with "stop" pins so that the multipliers can vary between 0.1000 to 0.9999. The output frequency of the decade scaler is always restricted to a range of from 0.1000 X 2.56 MHz to 0.9999 X 2.56 MHz.

The output of the decade scalers is divided by a combined "up" and "down" counter which first counts up by 128 and then down by 128. The input to the counter is divided by 256 and converted to a triangular waveform by the summing amplifiers, the output frequency of which falls within the range of 1,000 Hz to 9,999 Hz. By using decade dividers, this range can be reduced by 10 or by 100.

Back-to-back diodes are used to convert the triangular waveform to a sinusoid.

The sinusoid is gated through seperate channels, permitting seperate level controls for the two sequential tones, and eventually is preamplified and fed to the output amplifiers.

The complimentary transistorized output amplifier provides a low distortion, low impedance output of up to 3 volts rms. into a 600 ohm load.

Terminals are accessable at the rear of the unit, with which two or Model 1333A's may be slaved together to produce various combinations of tones. See the Operation Section for correct interconnecting methods.

Switches are also available at the rear of the unit, permitting switching of the delay circuits in or out when **desired.**

3. DESIGN FEATURES:

a. The Model 1333A Solid State Digital Generator is a self contained, solid state unit which generates single or dual sequential tones with synthesizer accuracy and stability.Ideal for Private Line equipment.

b. Thumbwheel switches make frequency selection simple and accurate.

c. Calibrated delay and duration generators automatically sequence single or combined tones.

d. Two or more Model 1333A units may be slaved together permitting combinations of sequenced tones, as required in servicing 2 tone pagers and Quick Call II.

3. DESIGN FEATURES - CONT'D

e. Separate level controls for each tone allow adjustment to compensate for preemphasis, frequency response, etc. in transmitters and receivers over a 20 db range.

f. Up to 3 volts rms. output into 600 ohms permits modulation of even the older type Signal Generators. Distortion is less than 1.5% at 3V rms.

g. Solid-State "Light Emitting Diodes" are used as timing indicators It is possible to tell "at a glance" which tone or delay is cycled "on". Ease of operation was an important design consideration in the Model 1333A.

4. CONTROL FUNCTIONS

a. POWER

1. The On-Off switch controls the application of a.c. power to the unit.

2. A 1/4 A fuse, located at the rear of the instrument protects against overvoltage and overload.

b. Thumbwheel switches "A" and"B" control the frequency of the tones. The first digit of each thumbwheel switch includes stop pins which keeps the digit from being set to zero.

c. Adjacent to each thumbwheel switch is a frequency multiplier switch marked X1, X0.1, X0.01 HERTZ. These permit frequency selection as follows:

Position	Output Frequency
X1	1000 to 9999 Hz
X0.1	100.0 to 999.9 Hz
X0.01	10.00 to 99.99 Hz

d. The cycle switch selects either single tone (A only) or dual sequential (A and B) operation.

e. The MODE switch selects continuous tone operation (CONT. A or
d CONT.B) or cycled operation. (BURST).

f. Delay Controls controls the delay time between tone bursts. The delays are adjustable and calibrated from 0.1 to 5 sec., as indicated by the light emitting diode above each control.

g. DURATION controls control the duration of the tone 'on' time. The duration is adjustable and calibrated from 0.1 to 5 sec. as indicated by the light emitting diode above the control.

4. CONTROL FUNCTIONS - CON'D

h. The CLEAR-CYCLE switch is alternate acting. Occasional transients in turning the power switch on and in other internal or external switching will turn two or more of the light emitting diodes on. Should this occur, clear the cycle by pressing the CLEAR-CYCLE SWITCH, allowing time for the interrupted cycle to complete. When all lights are 'off', press the CLEAR-CYCLE switch again to resume normal cycling.

This switch is also useful for "single" cycle operation. Simply clear the cycle by pressing the CLEAR-CYCLE switch, and allow time for the interrupted cycle to complete. When all lights are off, press the CLEAR-CYCLE SWITCH twice. The first press will start the cycle, the second will stop the unit from recycling after the cycle is completed.

i. The LEVEL A and LEVEL B controls are used to independently control the amplitude of each of the generated tones.

5. OPERATING PROCEDURE:

a. Switch Power switch to 'ON'. Because of the all solid state circuitry, no warm-up time is required.

b. Set the thumbwheel switches and the adjacent frequency multiplier switches to the desired tone frequencies. Note:

Position:	Output Frequency:
x1	1000 to 9999 Hz
x0.1	100.0 to 999.9 Hz
x0.01	10.00 to 99.99 Hz

c. Set the MODE switch to CONT A and adjust LEVEL A to the desired output voltage. (measured at the output terminals)

d. Set the MODE switch to CONT B and adjust LEVEL B to the desired output voltage.

e. Set MODE switch to BURST.

f. Set CYCLE switch to either A only or A & B as desired.

g. If MORE THAN ONE LIGHT EMITTING DIODE IS LIT AT ONCE, PRESS THE CLEAR-CYCLE SWITCH AND ALLOW TIME FOR THE INTERRUPTED CYCLE TO COMPLETE. WHEN ALL OF THE LIGHTS ARE OFF, PRESS THE CLEAR-CYCLE SWITCH AGAIN TO RESUME NORMAL AUTOMATIC CYCLING.

If single cycle operation is required, simply clear the cycle by pressing the CLEAR-CYCLE switch, and allow time for the interrupted cycle to complete. When all lights are off, press the CLEAR-CYCLE twice.

The first press will start the cycle, the second will stop the unit from recycling after the cycle is completed.

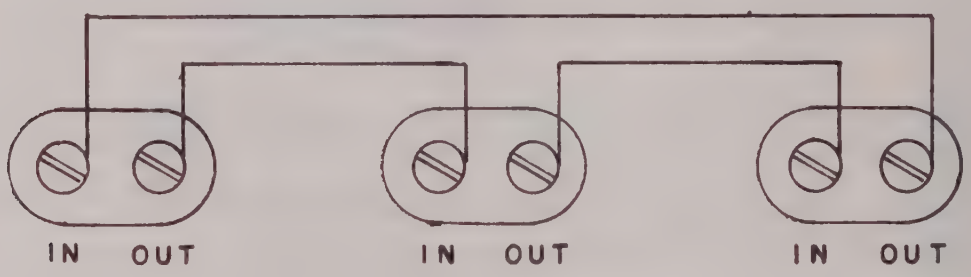
h. If desired, either (or both) A and B delay may be eliminated by switching the delay switches (located at the rear of the unit) to 'off'.

i. Two or more Model S-1333A may be slaved together through use of the screw type terminal strips located at the rear of the units (See Fig. 2).

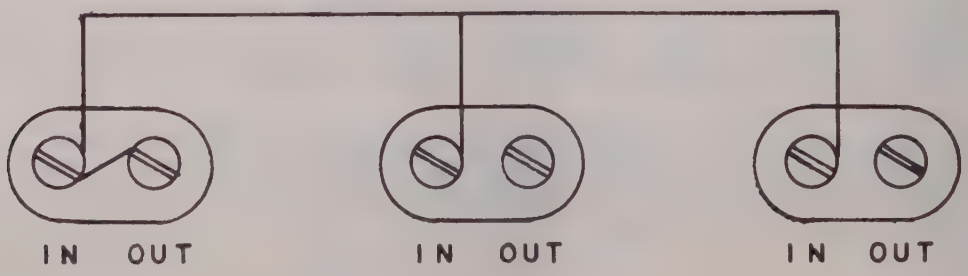
FIG. 2

For normal operation, short the input to output together, using bare tinned copper wires.

For sequential (series) operation, connect the units together as follows:



For simultaneous (parallel) operation, connect the units together as follows:



5. OPERATING PROCEDURE - CONT'D

Connect the grounds of all units together by interconnecting the black binding posts of the output terminals. Insulated hook-up wire can be used for interconnecting the units. Clear all units by pressing the CLEAR-CYCLE switches until all of the interconnected units are cleared. (All light emitting diodes are off.)

Pressing the CLEAR-CYCLE switch on all of the interconnected units will restart the cycling.

6. MODIFICATION OF THE P.C. BOARD

There are four identical timing circuits on the TIMING P.C. Board, one each for the two DELAY and two DURATION controls 10 ufd plus or minus 10% electrolytic capacitors are installed at the factory allowing all four functions to be varied from 0.1 to 5 seconds. If necessary, these timing capacitors can be increased or decreased to alter the range of delay or duration to accomodate special applications of the S-1333A units. Since the delay or duration is directly related to the size of the capacitor, it is a relatively simple matter to decide on a capacitor value for a given range.

For Instance:

For C = 5 ufd plus or minus 10% = 0.05 to 2.5 seconds.

CAPACITOR SUBSTITUTION TABLE

Calibration Marks	.1	1	2	3	4	5	Seconds
C = 20 ufd	.2	2	4	6	8	10	"
C = 10 ufd	.1	1	2	3	4	5	"
C = 5 ufd	.05	.5	1	1.5	2	2.5	"
C = 2 ufd	.02	.2	.4	.6	.8	1	"
C = 1 ufd	.01	.1	.2	.3	.4	.5	"
C = .5 ufd	.005	.05	.1	.15	.2	.25	"

7. MAINTAINANCE

a. GENERAL PRECAUTIONS

1. The purpose of this section is to acquaint operating and maintenance personnel with the procedures for making certain adjustments that may be necessary after critical parts are replaced.

7. MAINTENANCE - CONT'D

a. GENERAL PRECAUTIONS - Cont'D

2. It should be noted that most of the field replacable parts are available, from Motorola. Please refer to MOTOROLA'S part numbers when ordering. The adjustment procedures outlined in this section should be carefully followed. When the described test equipment is not available, it would be advisable to return the Model S-1333A for repair.

3. When removing or installing printed circuit boards, turn power 'OFF' to prevent accidential damage to the circuitry.

b. REMOVING THE INSTRUMENT FROM THE CASE

1. Remove the power cord.

2. Place the instrument panel down on a cushion or soft surface.

3. Remove three 6-32 Phillips head screws from the rear and sides of the case.

4. Gently lift case from the unit.

c. POWER SUPPLY ADJUSTMENTS

1. Measure plus 14V, plus and minus 4.8V at the test points on the Power Supply P.C. Board (See Page 15) using a voltmeter accurate to plus or minus 3%.

2. If voltage measures within plus or minus 3% of stated values, do not alter adjustments.

3. If voltages require adjustment, start by adjusting the plus 14V supply using RV3. Then adjust the +48V supply using RV1. Finally, adjust the -48V supply using RV2.

d. TIMING CIRCUIT ADJUSTMENTS

1. Set the front panel controls DELAY A, DURATION A, DELAY B, DURATION B to 5 Sec. Use either an oscilloscope with an accurate time base (connected to the Model S-1333A OUTPUT binding posts) or an accurate clock or watch (observe the light emitting diodes) to measure delay and duration time. Set DELAY A by setting RV22, DURATION A by setting RV20, DELAY B by setting RV21, and DURATION B by setting RV23, for exactly 5 sec. each.

e. OUTPUT P.C. BOARD ADJUSTMENTS

1. Set the front panel controls:
Thumbwheel A to 1000
A Multiplier to X1 Hertz
MODE Switch to CONT. A
LEVEL A control to maximum
POWER SWITCH "ON"

e. OUTPUT P.C. BOARD ADJUSTMENTS - CONT'D

2. Connect an oscilloscope to the OUTPUT binding posts of the Model S-1333A.

   Adjust the oscilloscope vertical gain controls and sweep adjustments so that the 1000 cycle tone may be viewed at about half vertical full scale.

3. Adjust bias control RV62, that the 1000 cycle tone starts to be clipped at the top. Readjust RV62, so that clipping can be seen at the bottom of the sine wave. Set RV62 at the midpoint between these two positions. This will be close to the optimum bias point for the audio amplifier section.

4. Also connect a Harmonic Distortion Analyzer to the OUTPUT binding posts. Measure harmonic distortion of the output wave. Adjust both symmetry, adjust pot RV61 and Distortion , adjust pot RV60 for minimum distortion (should be less than 1.5%).

5. Recheck distortion at several frequencies throughout the range. Distortion should always be less than 1.5%.

6. Set MODE switch to CONT. B. Rotate LEVEL A control back and forth about a quarter of a turn and adjust trimmer RV63 for minimum vertical shift of the oscilloscope pattern. When properly adjusted, the trace will not move as LEVEL A is rotated. Readjust RV62 as in paragraph 3 if clipping occurs.

7. Set CYCLE Switch to A ONLY and MODE Switch to BURST. Set the 'A' DELAY and 'A' DURATION for 0.1 sec. Adjust RV62 so that the sinusoid centers about the trace during the delay period.

8. Set the MODE switch to CONT. A. Rotate LEVEL B control back and forth about a quarter of a turn and adjust trimmer RV64 for minimum vertical shift of the oscilloscope pattern. When properly adjusted, the trace will not move as LEVEL B is rotated. Readjust RV62 as in paragraph 3 if clipping occurs.

9. Switch the MODE Switch back and forth from CONT. A to CONT. B. AdjustRV64 for minimum vertical shift of the oscilloscope pattern. When properly adjusted, the trace will not move when the MODE Switch is alternately switched from CONT. A to CONT. B.

10. Readjust bias control RV62 as in Paragraph 3. If a variac is available, adjust the line voltage applied to the S-1333A alternately to 100 VAC and 130 VAC. Readjust RV62 to eliminate clipping at either voltage extreme.

e. OUTPUT P.C. BOARD ADJUSTMENTS - CONT'D

11. With the line voltage at 115 VAC, adjust RV60 and RV61 for minimum distortion less than 1.5%. Adjust the line alternately to 100 VAC and 130 VAC. If distortion increases beyond 1.5%, readjust RV62. When RV62 is properly adjusted, distortion will not increase more than 0.25% at the line voltage extremes.

12. Recheck steps 6 thru 11. Proper adjustment of the Output Board controls will assure optimum performance and minimum distortion throughout the operating temperature range of the instrument.

Model S-1333A, Solid State Digital Tone Generator

Reference Symbol	Motorola Part No.	Description
		CAPACITORS
C-7		Polyester .1 mf
C-8		Disc Ceramic,100 pf 10% 1000V
C-24,25,26,27,9, 33,10,11	8P84200D86	Polyester .01 mf
C-28, 29,30,31,32,63		Disc Ceramic, 15 pf 10% 1000V
C-60,61,64,65	8P84200D87	Polyester .0047 mf 10% 400V
C-62		Polyester .001 mf
C1	23P84200D82	Electrolytic 200 mf 25V
C2,3	23P84200D83	" 2000 mf 15V
C4	23P84200D84	" 1000 mf 15V
C5,6,20,21,22,23	23P84200D85	" 10 mf 10% 20V
		RECTIFIERS - BRIDGE
CR1	48P84200D79	MDA 920A-1
CR2	48P84200D80	MDA 920A-2
CR3	48P84200D81	MDA 942A-1
		DIODES
CR4	48P84200D77	IN5227A 3 6V Zener
CR5	48P84200D78	IN5237A 8 2V Zener
CR20,21,22,23,60, 61,62,63,68,thru 101	48C82420C05	IN914
		FUSE
F1	65K20987	3AG 1/4 amp.
		INTEGRATED CIRCUITS
IC 10,11,12	51P84200D64	MC7420P
IC 13,40,41,50,51	51P84200D65	MC7450P
IC 14,15,34,42,43, 44,45,52,53,54,55	51P84200D66	MC7473P
IC 16,20,21,22,23	51P84200D67	MC7400P
IC 30,31	51P84200D68	MC7490P
IC 33	51P84200D69	MC7401P
IC 60,61	51P84200D70	CA3029
IC 35		MC7453P

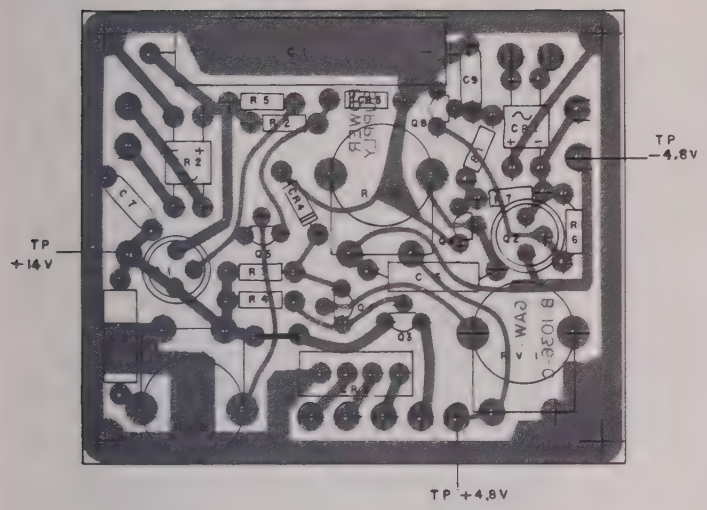
MODEL S-1333A, SOLID STATE DIGITAL TONE GENERATOR

Reference Symbol	Motorola Part No.	Description
		CONNECTORS
J1	46K863924	Binding Post Black
J2	46K863925	Binding Post Red
J3	9P84305A27	Receptacle, Male
		INDUCTORS
L 1,2		Line Filter
		TRANSISTORS
Q1	48P84200D71	40314
Q2	48P84200D72	40319
Q3,4,5,8,60,thru-68	48P84200D73	2N5223
Q6,69,70,71,72	48P84200D74	2N5227
Q7	48P84200D75	2N5294
Q20,21,22,23,24,25	48P84200D76	MPS - A13
		RESISTORS
R1		Fixed Comp. 18 10% 1/4 W
R113,114	6K129235	Fixed Comp. 1.2K 10% 1/4 W
R5,7,2,3,4	6R128689	Fixed Comp. 2.2K 10% 1/4 W
R10,26,27,28,29,40, 41,43,76, thru 89,111, 112,115,116,117,6	6R129805	Fixed Comp. 1K 5% 1/4 W
R102		Fixed Comp. 4.7K 10% 1/4 W
R20,21,22,23 95,96, 8 &9	6R129225	Fixed Comp. 10K 10% 1/4 W
R24,25,103,105	6P84201D03	Fixed Comp. 20K 5% 1/4 W
R34, 35,36,37,38,14,15		Fixed Comp. 390 ohm 10% 1/4 W
R30,31,32,33,90,91 92,6 and 7	6R129753	Fixed Comp. 100 ohm 10% 1/4W
R50,51,52		Fixed Comp. 910 ohm 5% 1/4 W
R61		Thermistor, 5000 ohms 10%
R62 thru 68	6P84200D88	Fixed Film 51.1 ohms 1% 1/8 W
R69	6P84200D89	Fixed Film 1.0K 1% 1/8 W

Reference Symbol	Motorola Part No.	Description
		RESISTORS - Cont'd
R70	6P84200D90	Fixed Film 2.0K 1% 1/8W
R71	6P84200D91	" " 4.02K 1% 1/8W
R72	6P84200D92	" " 8.06K 1% 1/8W
R73	6P84200D93	" " 16.2K 1% 1/8W
R74	6P84200D94	" " 32.4K 1% 1/8W
R75	6P84200D95	" " 64.9K 1% 1/8W
R93, 94	6K129755	" " Comp.10 ohm 10% 1/4W
R98,99		" " " 1.0K 10% 1/4W
R100	6R129242	" " " 56K 10% 1/4W
R101	6P84201D05	" " " 9.1K 5% 1/4W
R104	6R129708	" " " 1.2K 5% 1/4W
R106, 107	6R129820	" " " 1.8K 5% 1/4W
		RESISTORS VARIABLE
RV 1,2,3	18P84200D96	5K 20% 1/2W
RV 4,5,6,7	18P84200D97	1M 20% 2W
RV 8,9	18P84200D98	1K 20% 2W
RV 60	18P84200D99	25K 20% 1/2W
RV 62	18P84201D01	250 ohms 20% 1/2W
RV 20,21,22,23	18P84201D02	1000 ohms 20% 1/2W
RV 63,64		2000 ohms 20% 1/2W
RV 65,66 , 67		10,000 ohms 20% 1/2W
RV 50, 51,52		200 ohms 20% 1/2 W
RV 61		100 ohms 20% 1/2 W

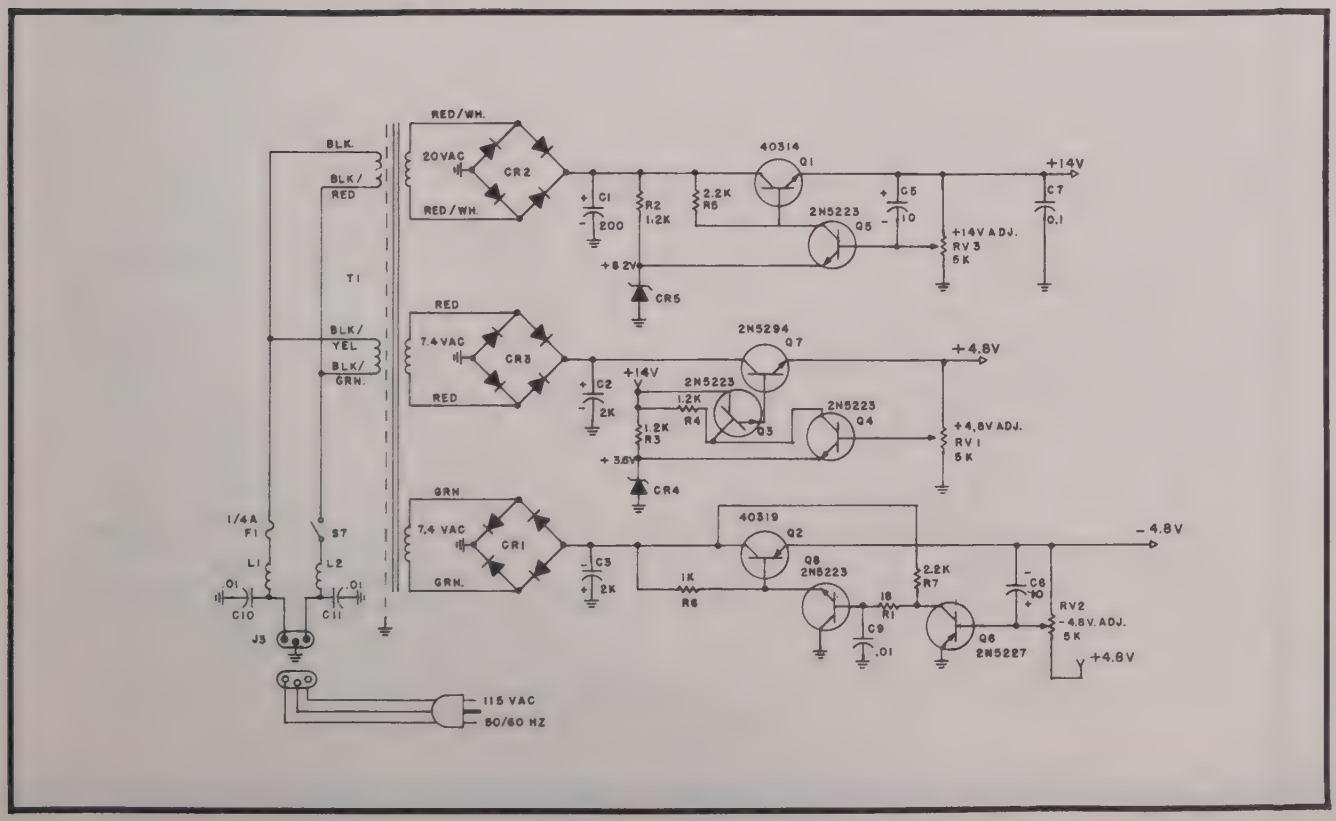
MODEL S-1333A, SOLID STATE DIGITAL TONE GENERATOR

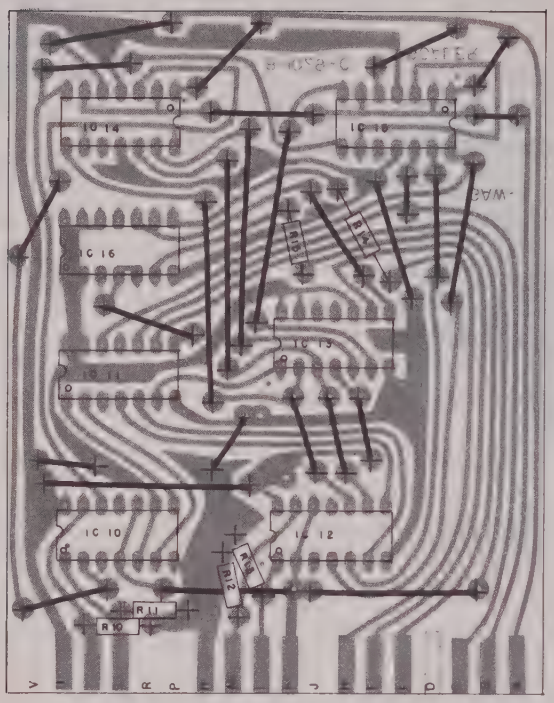
Reference Symbol	Motorola Part No.	Description
		SWITCHES
Sw1,2	40P84200D61	Delay
SW3,4	40P84200D60	x1, x01,x.01
SW5,	40P 84200D60	Mode
SW6,	40P84200D61	Cycle
SW7,	40P84200D62	Power
SW8,9	40P84200D57	Thumbwheel
SW 10,	40P84200D63	Clear-Cycle
		TRANSFORMER
T1	25P84200D56	Transformer
		MISCELLANEOUS
	1P84200D48	P C.Board Assy.Power Supply
4 required	1P84200D49	P.C.Board Assy.Decade Scaler
	1P84200D50	P.C.Board Assy.Timing
	1P84200D51	" " " Misc.
	1P84200D52	" " " U-D Part 1
	1P84200D53	" " " U-D Part 2
	1P84200D54	" " " Output
	1P84200D55	" " " Diode Mtg.
W1	30P84303A93	Cord, Power
Y1	K1035A-1T0C	Oscillator, Crystal



POWER SUPPLY
PRINTED CIRCUIT BOARD
ASSEMBLY

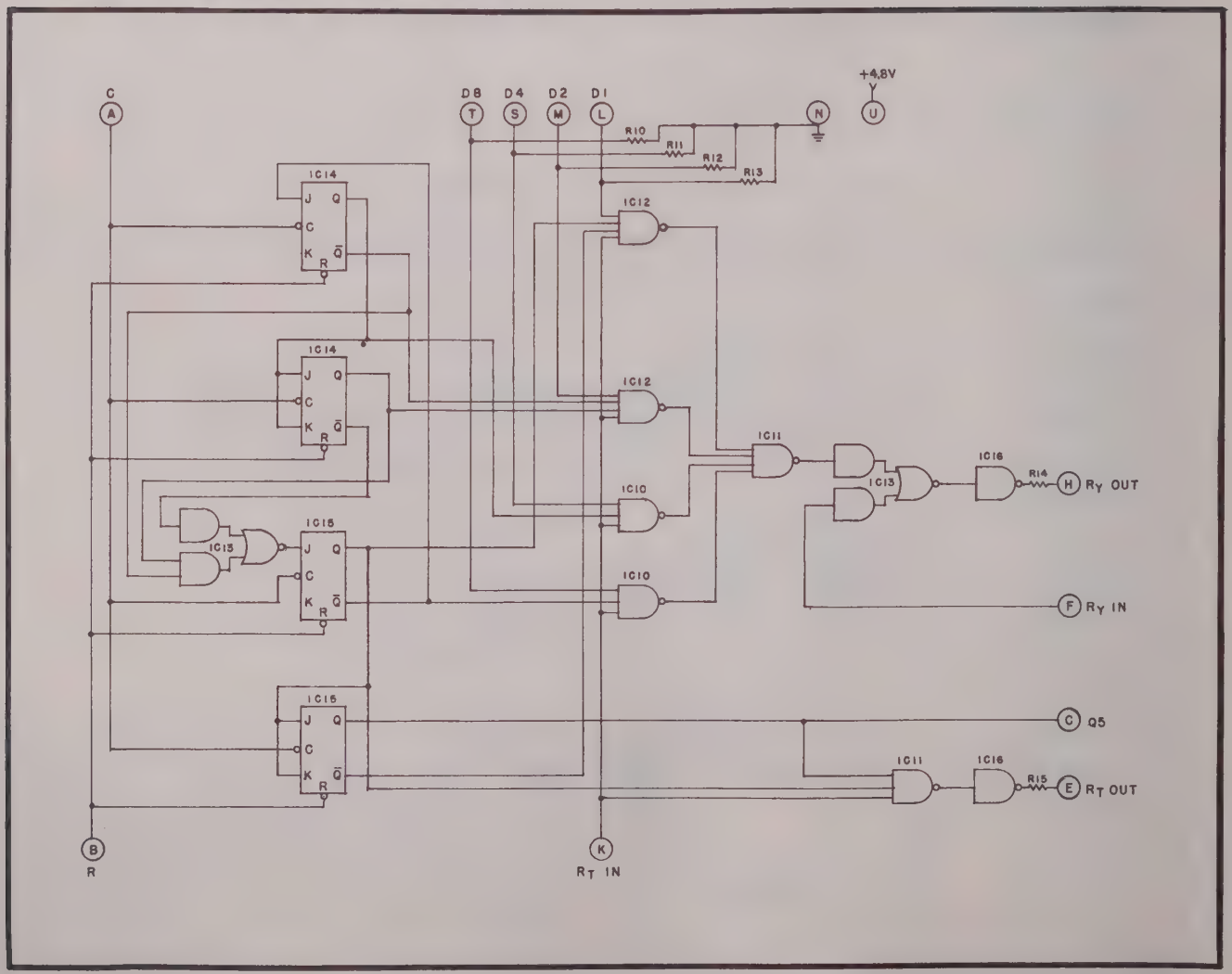
1P84200D48

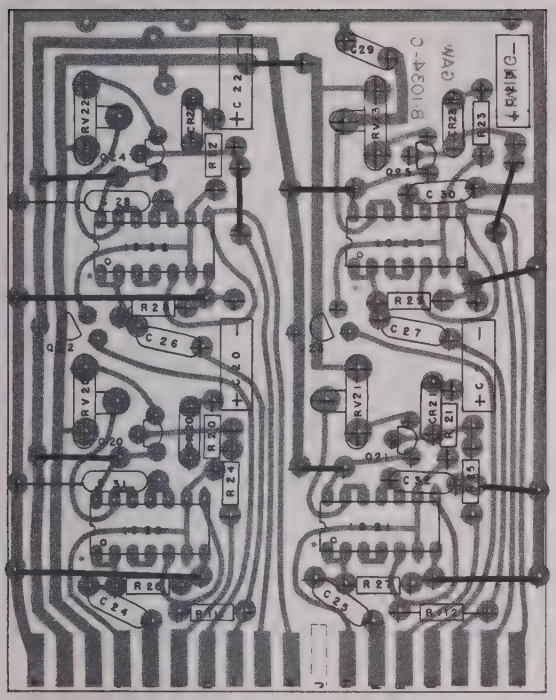




DECADE SCALER
PRINTED CIRCUIT BOARD
ASSEMBLY

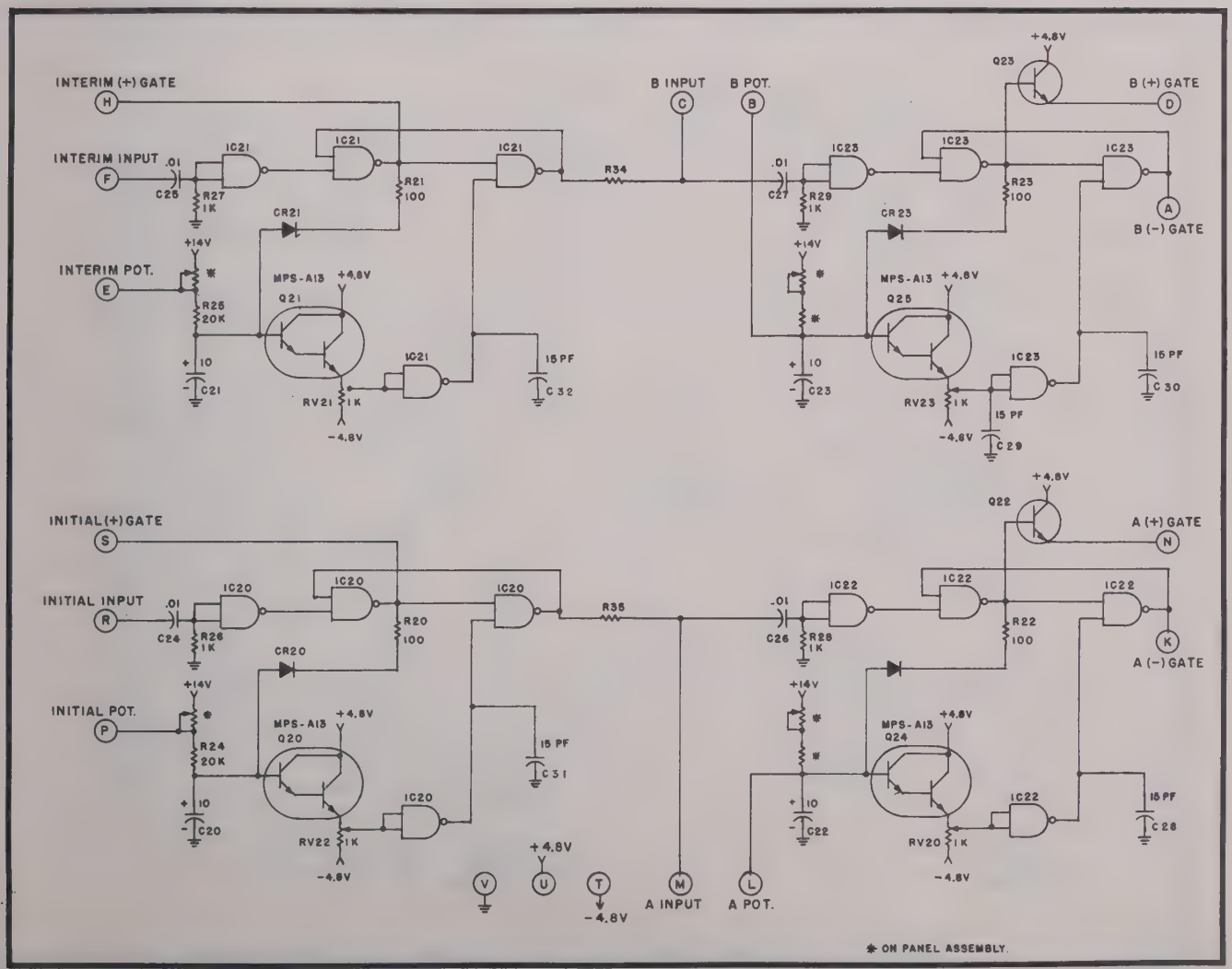
IP84200D49

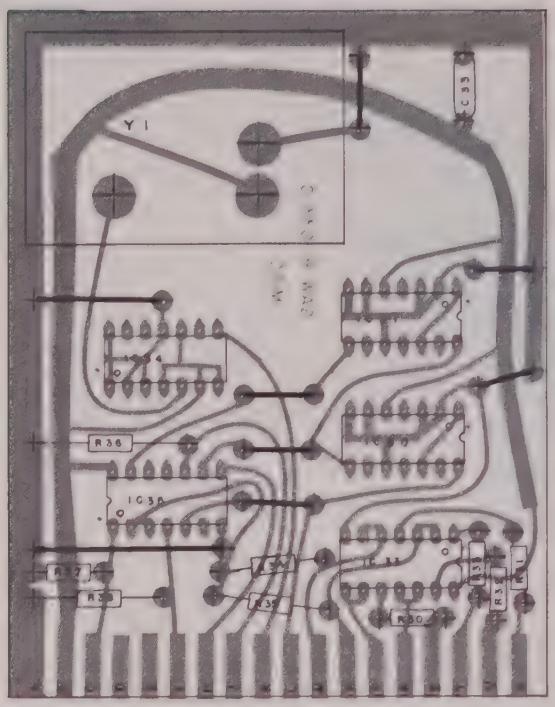




TIMING
PRINTED CIRCUIT BOARD
ASSEMBLY

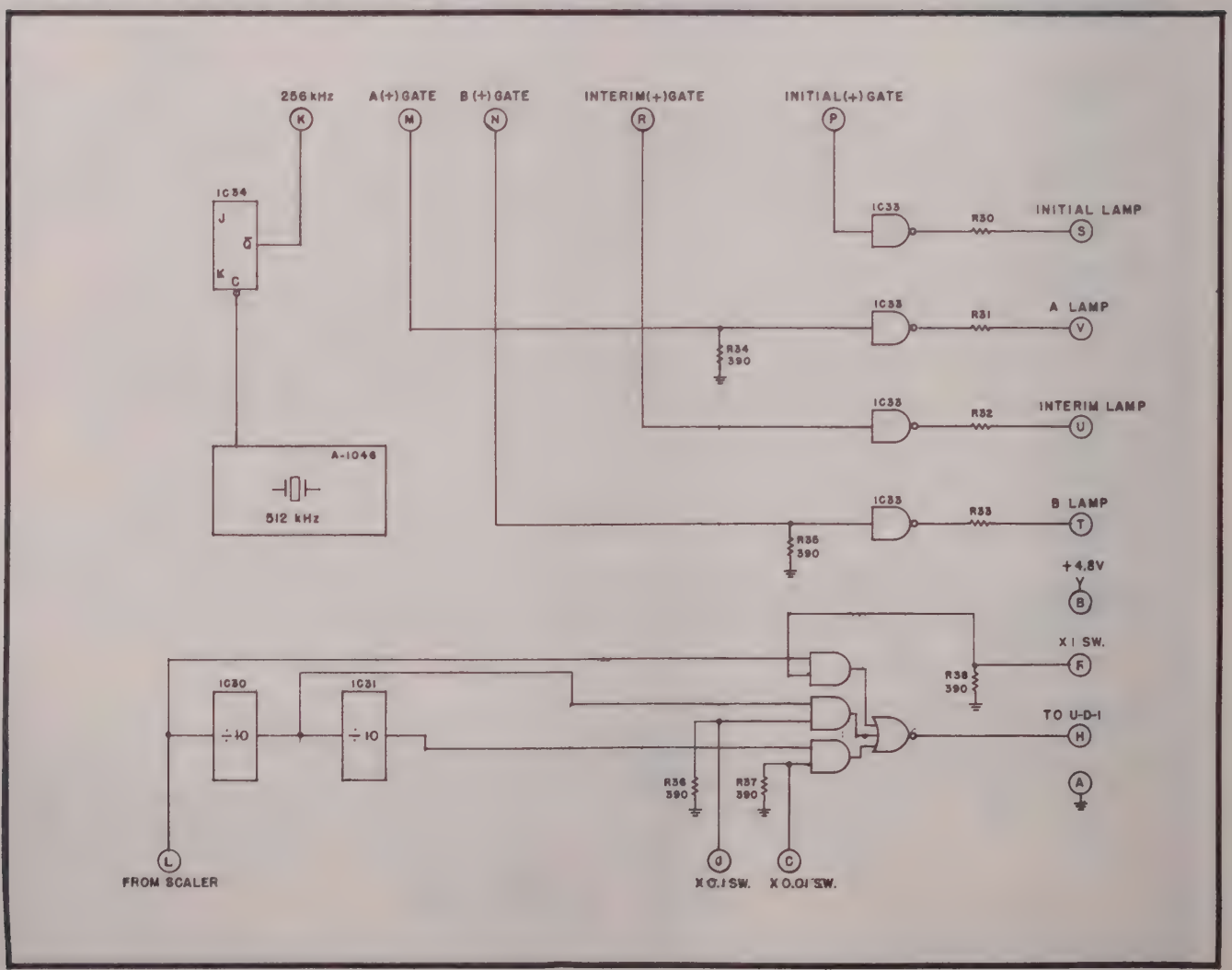
1P84200D50

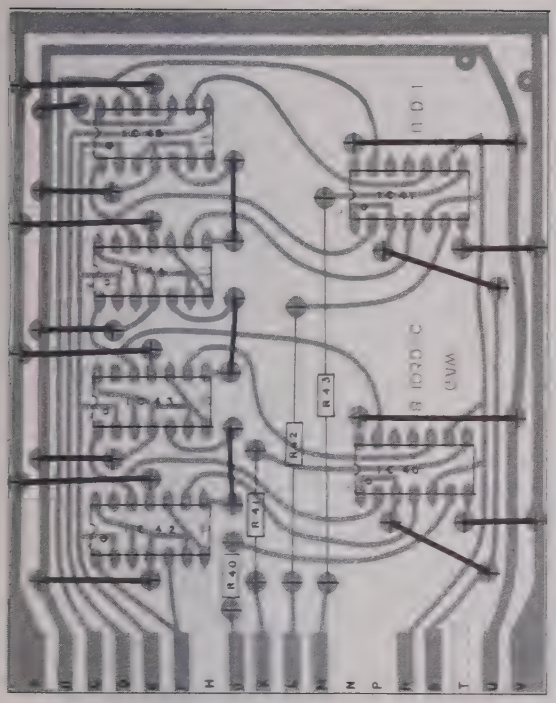




MISCELLANEOUS PRINTED CIRCUIT BOARD ASSEMBLY

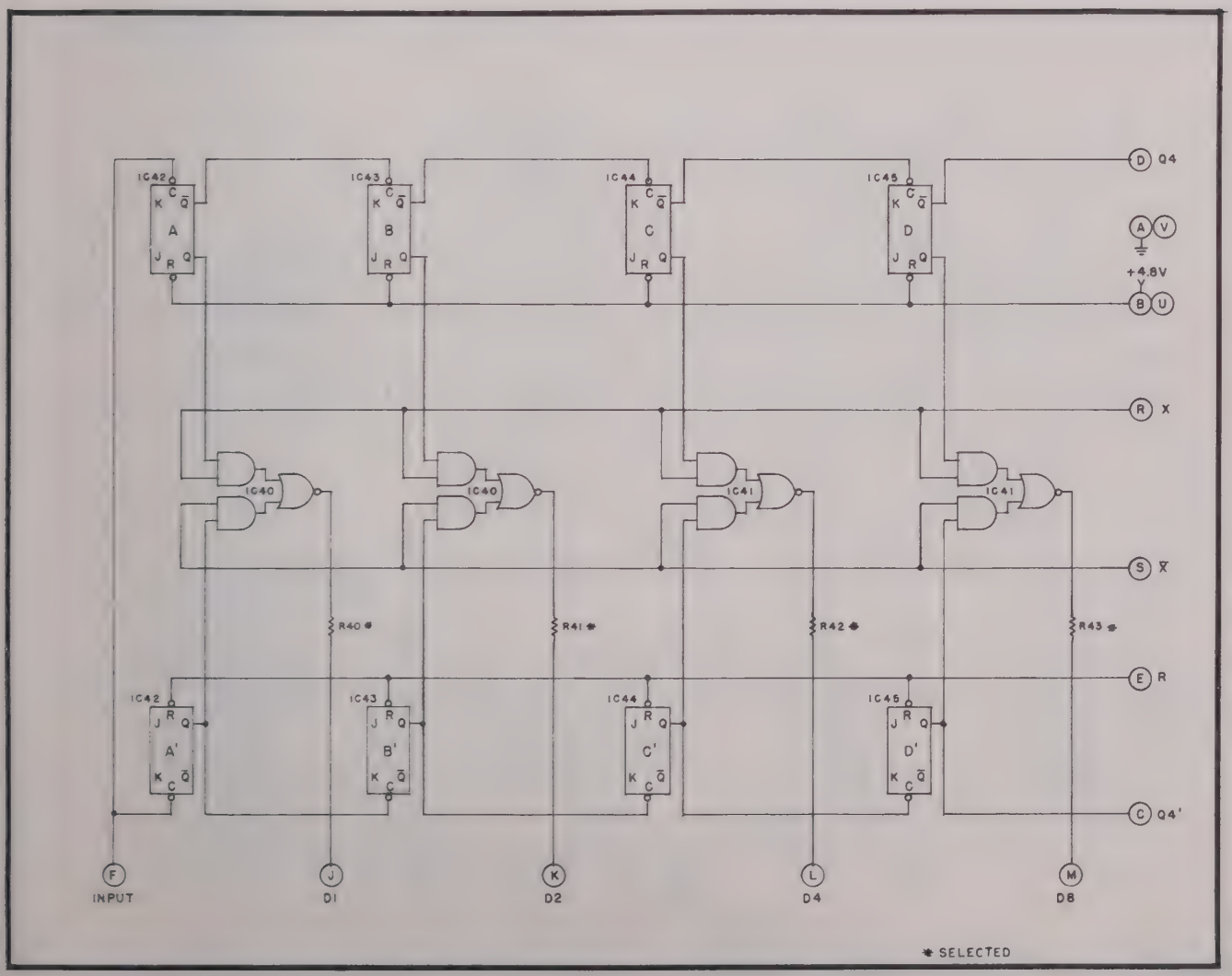
1P84200D51

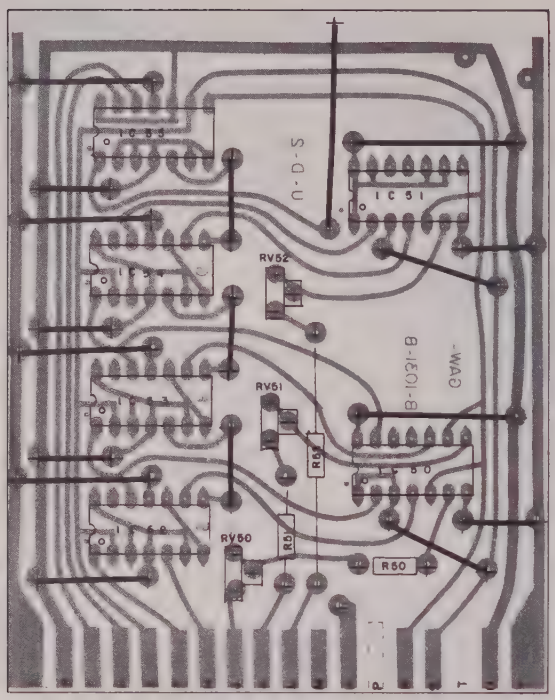




U-D Part 1
PRINTED CIRCUIT BOARD
ASSEMBLY

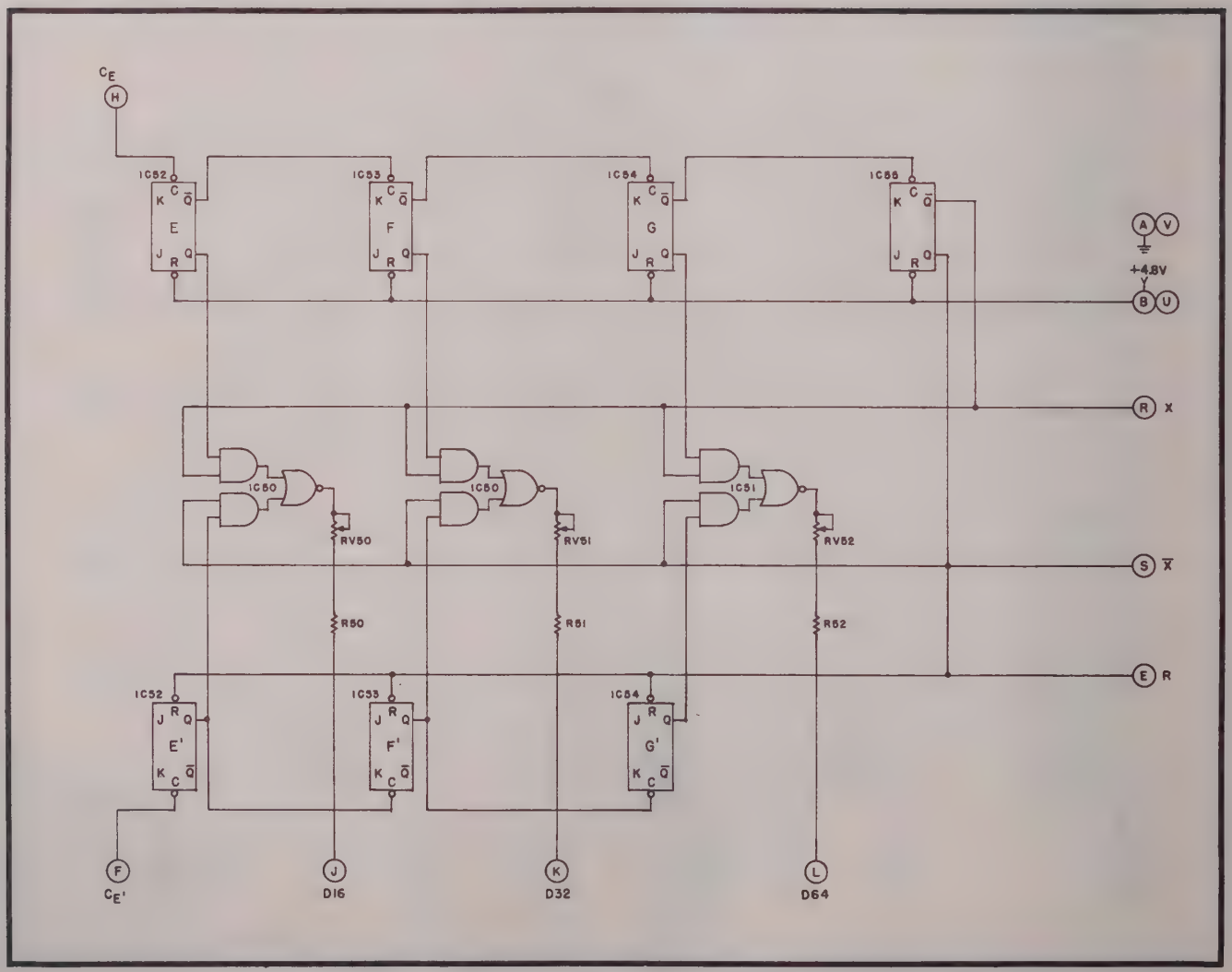
1P84200D52

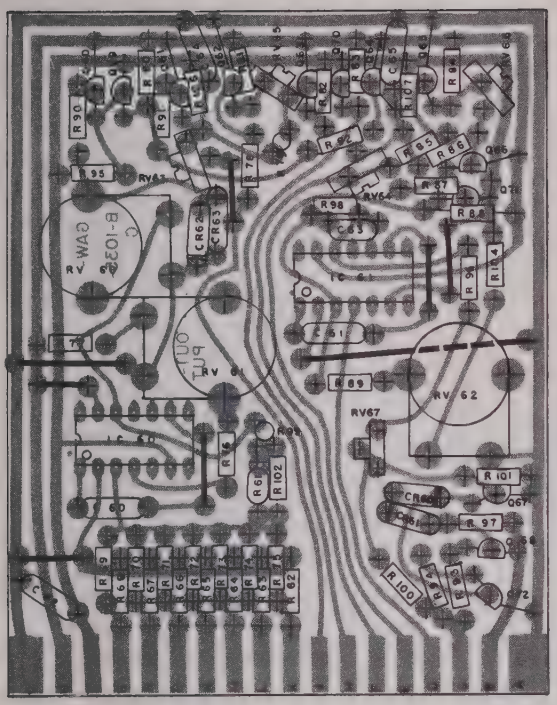




U-D Part 2
PRINTED CIRCUIT BOARD
ASSEMBLY

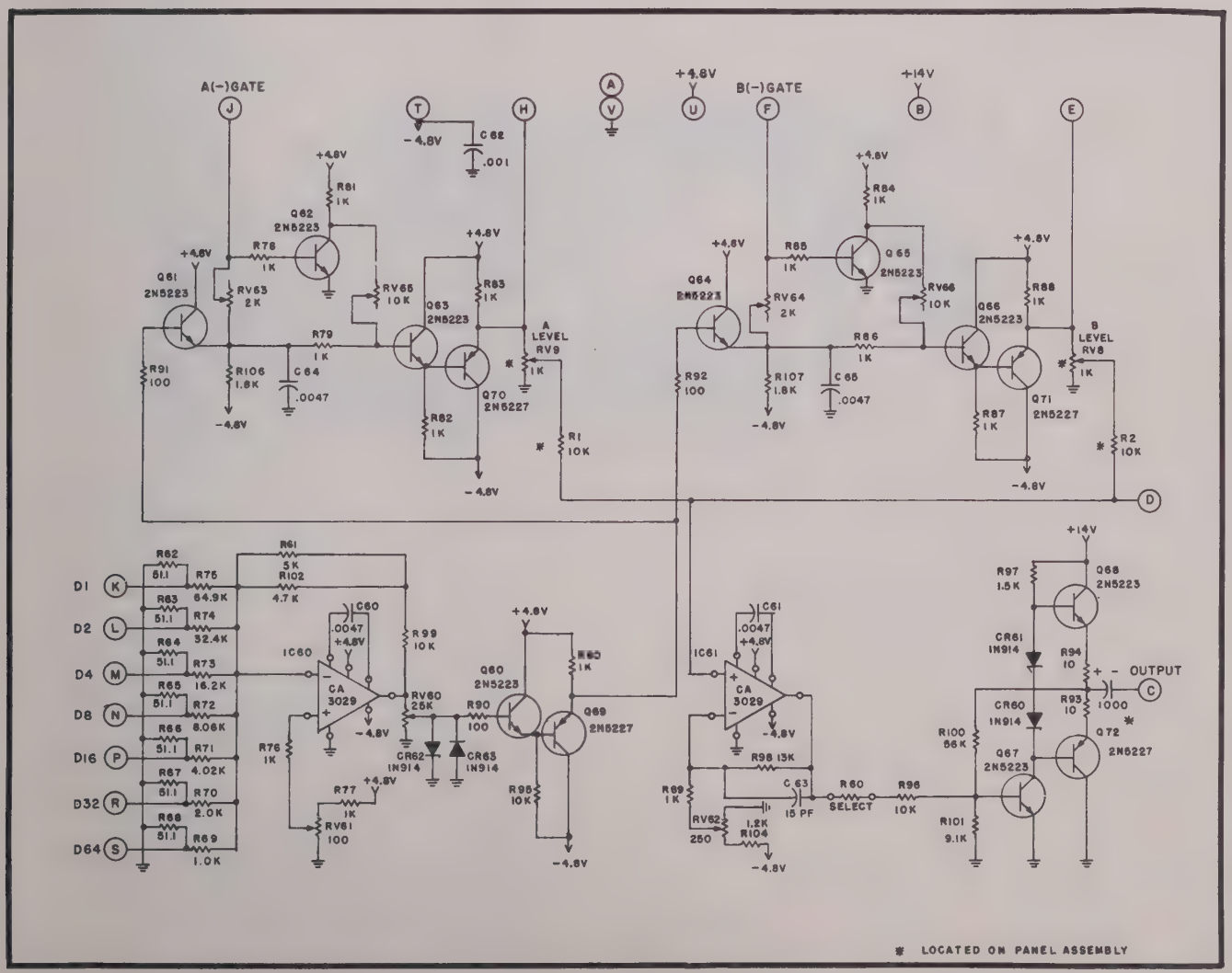
1P84200D53





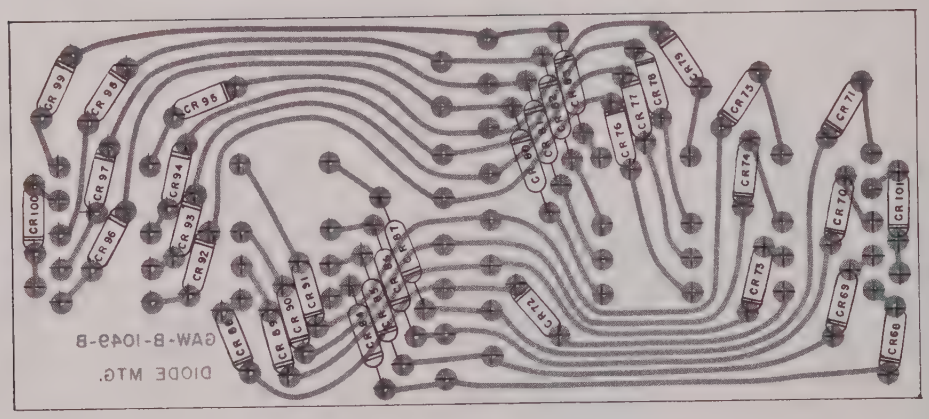
OUTPUT
PRINTED CIRCUIT BOARD
ASSEMBLY

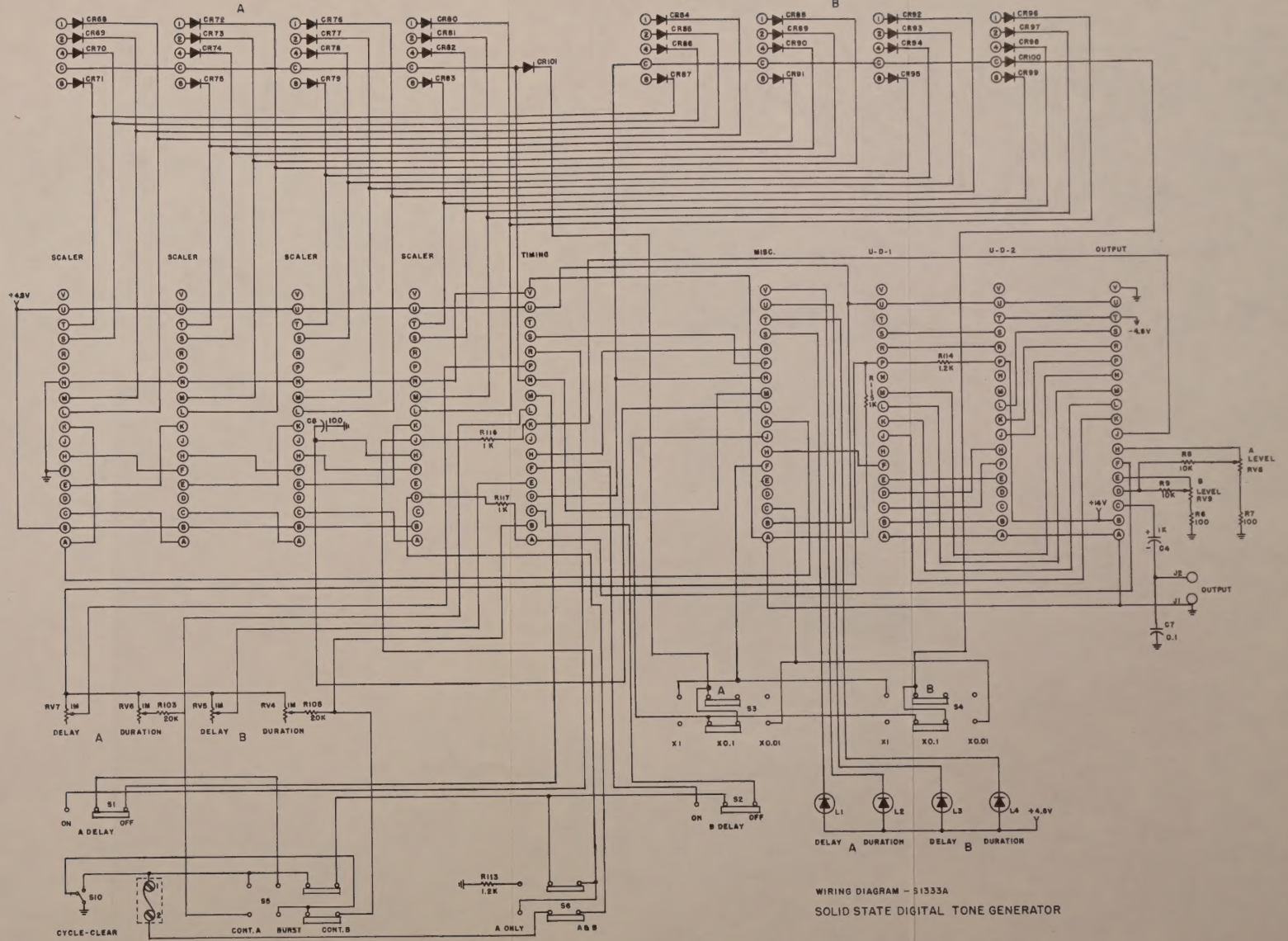
1P84200D54



DIODE MOUNTING
PRINTED CIRCUIT BOARD ASSEMBLY

1P84200D55





WIRING DIAGRAM – S1333A

SOLID STATE DIGITAL TONE GENERATOR

88283

MP MASTER
MA27820